PHYTOTOXICOLOGY VEGETATION ASSESSMENT SURVEY: CANADA BRICK, BURLINGTON, (1992)

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Phytotoxicology Vegetation Assessment Survey: Canada Brick, Burlington (1992)

Introduction

In 1992, MOE Central Region (Halton-Peel District office) requested that a Phytotoxicology survey be conducted in the vicinity of Canada Brick (CB), Burlington, to determine the effects of fluoride emissions on surrounding vegetation. Previous vegetation surveys (1986-1991) have shown that CB emissions of fluoride have increased since expansion of the brick production facilities in late 1986 through mid-1987. The present report presents the results of a survey conducted by R. Emerson, Phytotoxicology Specialist, on August 27, 1992.

The east and north boundaries of CB lie adjacent to the Bronte Creek Valley. The west boundary borders CNR tracks and is neighboured to the immediate west by scrub land and commercial/industrial properties. Neighbouring the southern boundary were commercial and residential properties abutting on Dundas St. (see attached map).

Sampling / Field Inspection

On August 27, 1992, tree foliage was collected from exposed middle branches at the same sites that were sampled in previous years both close to CB (Sites 1 to 7 & 12) and more remote (8, 9, 11, 14, 15 & 16). At each site, duplicate foliage samples were collected using standard sampling procedures. Most sites were situated off company property, Sites 1, 2 and 3 being the exceptions (see map).

In addition, foliage of trees and other vegetation in the vicinity of the collection sites was inspected for fluoride injury. The inspections in 1992 revealed that wild grape was the species most severely and extensively injured by fluoride emissions in the survey area. Wild grape is one of the most sensitive plant species to fluoride. The wild grape plants most adversely affected were growing in the vicinity of Sites 2 and 3 (on company property), just east of CB. In the vicinity of these sites, a few grape plants had leaves with moderate (11-35%) or severe (>35%) injury, with the injury severity being either light (2-10%) or light to moderate overall. Wild grape plants near Site 4 (southeast of CB), and near Sites 7 and 16 (west of CB), had trace to moderate injury, but the injury severity was light (2-10%) overall. Foliar injury was inconsequential (0-1%) at sites more remote from the company. Overall, in 1992, wild grape plants in the survey area were less severely injured than in 1991.

The foliar inspections in 1992 also revealed light injury typical of fluoride on gladiolus plants on the residential property adjacent to Site 5. Some silver maples, including Site

3, had some leaves with tip necrosis (dark brown), which is not uncommon in late August. At silver maple Site 3, the severity of tip necrosis was only trace (0-1%) overall. As in previous years, sugar maple trees exhibited injury that was suspected to be weather-related and Manitoba maples had foliar injury characteristic of Boxelder borer insect attack.

Vegetation elsewhere in the vicinity of CB (e.g. Eastern white pine) did not have foliar injury attributable to fluoride emissions.

Sample Submission / Discussion of Analytical Results

The foliage samples were returned to the Phytotoxicology laboratory, where they were processed on an "unwashed" basis (oven-dried, ground and stored in glass jars). They were then submitted to the MOE Laboratory Services Branch for fluoride analysis.

The attached table summarizes the fluoride results for the unwashed foliage samples collected from 1986 to 1992. The results in 1992, as in previous years, displayed a pattern of decreasing fluoride concentrations with increasing distance from the brickwork.

As in previous years, the highest fluoride concentration was detected at Site 7 (165 ug/g) immediately west of CB. The next highest levels (99 and 94 ug/g) were detected on company property (Sites 3 and 2) to the east. The residential area along the south side of Dundas Street (Sites 4, 5, 6, 12) had lower fluoride levels, ranging from 48 to 77 ug/g.

All sites, except more distant Sites 9, 11 and 14, had a mean fluoride concentration greater than the 15 ug/g rural Upper Limit of Normal guideline (see appendix). The two highest foliar levels (165 & 99 ug/g) were 10 and 6 times higher than the rural ULN.

Foliar fluoride concentrations in 1992 generally were lower than the 1987 through 1991 results. The greatest reduction in fluoride occurred at Sites 2 and 7, where the highest levels were recorded in 1991. The 1992 mean for all common sites (68 ug/g) also was lower than the 1987 through 1991 annual means (range 96-128 ug/g).

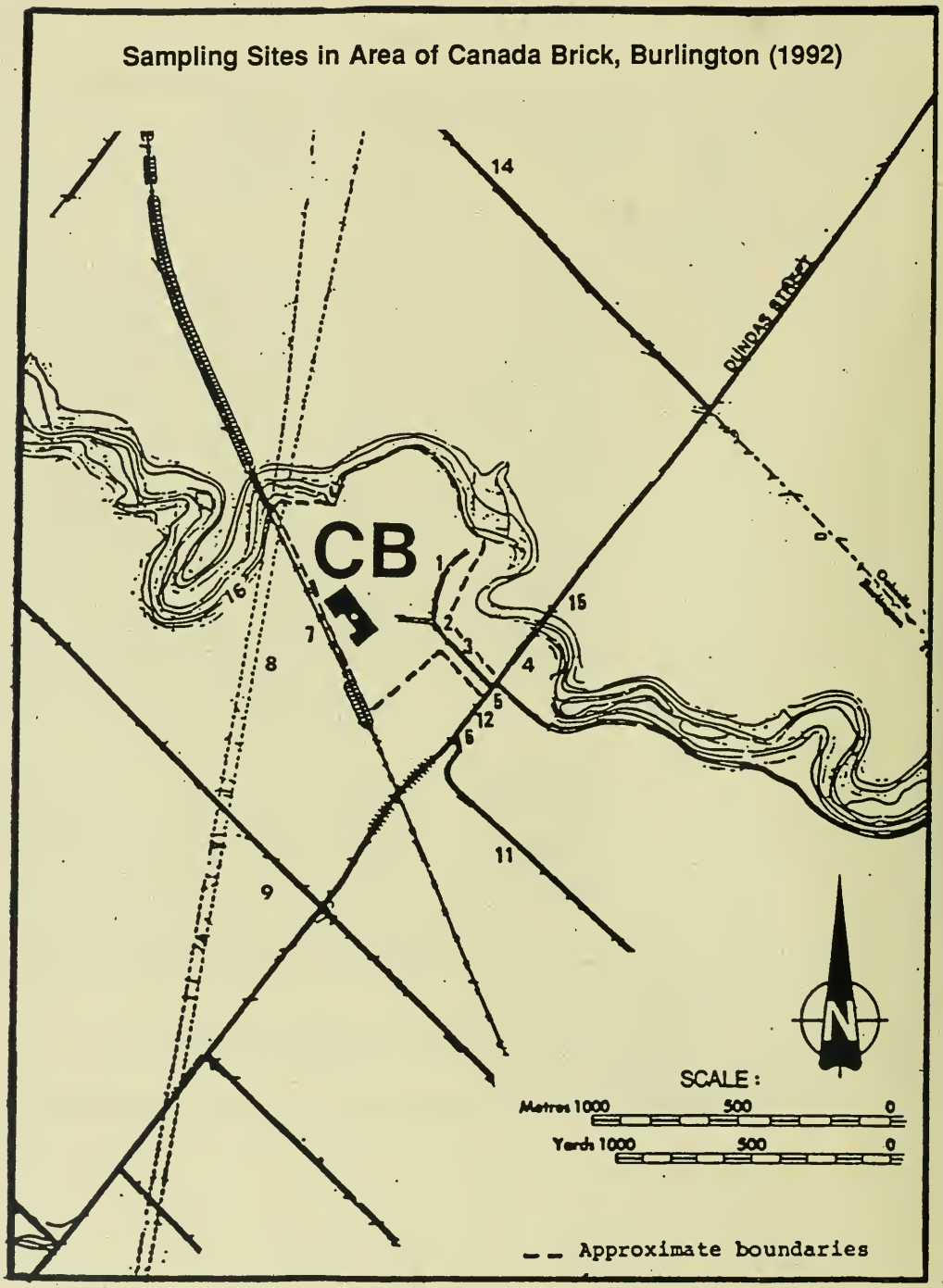
The reduction in foliar fluoride concentrations in 1992 is suspected to be largely due to extended periods of wet weather. Within limits, rain can remove fluoride, especially of the particulate type, by its washing action. This action can be reflected in the analytical results, wherein years with high rainfall should have lower fluoride concentrations if other factors are held constant. Conversely, dry years should be associated with higher fluoride levels. The precipitation data for the Toronto International Airport revealed that there was an abnormal amount of rainfall in both July (135 mm) and August (116 mm, through to and including August 27) compared with the respective Environment Canada climate normals (71 & 77 mm). In August alone (through to August 27), rain occurred on 13 days, with 10 days having received greater than 2 mm of rain.

Summary

The 1992 survey around Canada Brick, Burlington, revealed that foliar concentrations of fluoride were lower in 1992 than in previous years (1987-1991). Injury to sensitive vegetation (e.g. wild grape) also was reduced, with the most adverse effects, as in previous years, being confined to the immediate area of the company. The reduction in foliar fluoride concentrations is suspected to be largely attributable to abnormal wet weather in July and August. Canada Brick remains a significant but localized source of fluoride.

Analytical Results: Canada Brick (CB), Burlington - 1986 to 1992								
Site No.	Distance & Direction from CB	Foliage Type	Fluoride Concentration*					
			1986	1987	1989	1990	1991	1992
Sites Neighbouring CB								
1**	350m NE	Sugar Maple	43	127	107	54	62	47
2**	280m E	Sugar Maple	87	219	200	240	210	94
3**	400m ESE	Silver Maple	70	229	160	248	140	99
4	550m ESE	Manitoba Maple	33	69	64	66	61	48
5	540m SE	Silver Maple	35	131	135	102	135	77
6	540m SE	Manitoba Maple	20	58	68	50	71	50
7	125m WSW	Apple	160	269	290	63	285	165
8	300m WSW	Sugar Maple	17	54	65	17	55	19
12	530m SE	Silver Maple	15	89	120	70	86	56
15	700m E	Manitoba Maple	23	32	26	53	20	20
16	380m WNW	Silver Maple	NR	NR	NR	20	45	21
Mean of Common Sites			50	128	124	96	113	68
Sites More Remote								
9	960m SSW	Manitoba Maple Silver Maple	8 NR	9 NR	9 NR	7 11	9 10	9 NR
11	960m SE	Silver Maple	12	13	26	13	31	13
14	1480m NNE	Sugar Maple	4	7	6	5	7	3
Rural ULN* **			15					

* ug/g dry weight, mean of duplicate samples and analysis, except 1990 at Sites 3, 5, 6 & 12, where 4 samples/site were collected.
** Sites 1, 2 & 3 situated on company property
*** Phytotoxicology Section rural Upper Limit of Normal guideline, see appendix.
Note: Values underlined exceed ULN
NR - Samples not collected, no results


Sampling Sites in Area of Canada Brick, Burlington (1992)
CB
14
15
16
7
8
9
11
12
1
2
3
4
5
6
PLINOAS STREET
N
SCALE :
Metres 1000
500
0
Yards 1000
500
0
Approximate boundaries

Derivation and Significance of the MOE Phytotoxicology "Upper Limits of Normal" Contaminant Guidelines.

The MOE Upper Limits of Normal (ULN) contaminant guidelines represent the expected maximum concentration in surface soil, foliage (trees and shrubs), grass, moss bags, and snow from areas in Ontario not exposed to the influence of a pollution source. Urban ULN guidelines are based on samples collected from urban centres, whereas rural ULN guidelines were developed from non-urbanized areas. Samples were collected by Phytotoxicology staff using standard sampling procedures (reference: Ontario Ministry of the Environment 1992, *Phytotoxicology Field Investigation Manual*). Chemical analyses were conducted by the MOE Laboratory Services Branch.

The ULN is the arithmetic mean plus three standard deviations of the suitable background data for each chemical element and parameter. This represents 99% of the sample population. This means that for every 100 samples that have not been exposed to a pollution source, 99 will fall within the ULN.

The ULNs do not represent maximum desirable or allowable limits. Rather, they are an indication that concentrations that exceed the ULN may be the result of contamination from a pollution source. Concentrations that exceed the ULNs are not necessarily toxic to plants, animals, or people. Concentrations that are below the ULNs are not known to be toxic.

ULNs are not available for all elements. This is because some elements have a very large range in the natural environment and the ULN, calculated as the mean plus three standard deviations, would be unrealistically high. Also, for some elements, insufficient background data is available to confidently calculate ULNs. The MOE Phytotoxicology ULNs are constantly being reviewed as the background environmental data base is expanded. This will result in more ULNs being established and may amend existing ULNs.